APPENDIX B

AVIATION SUPPORT OF GROUND OPERATIONS

Army aviation's greatest contribution to the battlefield is providing the ground maneuver commander the ability to apply decisive combat power at critical times virtually anywhere on the battlefield. This combat power may be in the form of direct fire support from aviation maneuver units, the insertion of overwhelming infantry forces, or artillery fires delivered via air assault. This versatility gives the maneuver commander a decisive advantage on the battlefield. Ground maneuver commanders synchronize aviation maneuver with ground maneuver to enhance offensive and defensive operations. This synchronization allows the ground maneuver commander to shape the battlefield and to influence events throughout his AO.

B-1. ARMY AVIATION MISSIONS

Aviation units operate within the framework of the ground regime. As fully integrated members of the combined arms team, aviation units conduct combat, combat support, and combat service support operations 24 hours a day across the entire length and breadth of the AO.

a. **Combat Missions**. Aviation combat missions include--

- Reconnaissance
- Security.
- Attack.
- Air assault.
- Special operations.
- Theater missile defense (TMD).
- Support by fire.

b. **Combat Support Missions**. Aviation CS missions consist of the operational support and sustainment provided to forces in combat by aviation units. These include--

- Command, control, communications, and intelligence (C3I).
- Air movement.
- Electronic warfare.
- Aerial mine warfare.
- Combat search and rescue (CSAR).
- Air traffic services (ATS).

c. **Combat Service Support Missions**. Aviation CSS missions consist of the assistance provided by aviation forces to sustain combat forces. These include--

- Aerial sustainment.
- Casualty evacuation.

B-2. OFFENSIVE OPERATIONS

Aviation assets contribute during offensive operations by assisting the TF commander in finding, fixing, and engaging the enemy.

a. **Movement to Contact**. During movement to contact operations, aviation assets can find, fix, and destroy the enemy. This allows the maneuver commander to focus on finding the enemy in an expedited manner, thus allowing him to develop the situation early without premature deployment of the main body.

(1) AH-64 Apache and OH-58D helicopters are extremely effective in limited visibility during movement to contact operations due to their night vision capabilities.

(2) During movement to contact operations, aviation assets may perform additional tasks, to include--

- Conducting armed reconnaissance or reconnaissance in force to gain and maintain enemy contact.
- Screening the front, flank, or rear of the ground maneuver unit.
- Acting as the rapid reaction force to conduct hasty attacks during a meeting engagement.
- Providing suppressive fires to allow for disengagement of friendly forces.
- Conducting air movements for resupply.
- Conducting CASEVAC if necessary.

b. **Attack**. During attack operations, aviation assets can assist the ground maneuver commander in destroying targets throughout the TF AO through hasty and deliberate attacks. The commander may employ aviation assets to--

- Overwatch assault objectives.
- Attack the enemy's flank or rear to divert his attention away from the main or supporting attack.
- Conduct forward, flank, or rear screening.
- Conduct air assaults to seize key terrain.
- Conduct air movement of remotely monitored battlefield sensor system (REMBASS) equipment to assist in enemy detection.
- Provide air assault security.
- Conduct CASEVAC operations.
- Conduct reconnaissance operations.
- Conduct deception operations to prevent detection of the ground maneuver force.
- Enhance C2 by providing an air mobile platform for the TF commander.
- Provide pinpoint laser guidance for artillery fires.
- Conduct air movements for resupply.

c. **Exploitation**. During exploitation operations, aviation assets can assist the TF commander in maintaining the momentum gained by the attacking forces. The commander may employ aviation assets to--

- Attack the enemy's flanks and rear to maintain constant pressure on the defeated force.
- Attack rear area C2 and CSS assets.
- Act as reserve to blunt any counterattacks or to provide the decisive blow by attacking to destroy lucrative targets.
- Screen vulnerable flanks.
- Conduct air assaults to seize key terrain and maintain momentum.
- Provide air assault security.

- Conduct CASEVAC operations.
- Enhance C2 by providing an air mobile platform for the TF commander.
- Provide pinpoint laser guidance for artillery fires.
- Conduct air movements for resupply.

d. **Pursuit**. As the success of the exploitation develops, the speed of army aviation is ideally suited to maintain enemy contact, develop the situation, and deliver precision fires on enemy areas of resistance. The TF commander may employ aviation assets to--

- Attack to destroy, disrupt, or attrit counterattacking or reserve forces.
- Attack to fix withdrawing forces.
- Screen pursuing ground maneuver forces.
- Conduct air assaults to seize key terrain.
- Conduct air movement operations to resupply committed forces rapidly and maintain the momentum.
- Conduct CASEVAC operations.
- Enhance C2 by providing an air mobile platform for the TF commander.
- Provide pinpoint laser guidance for artillery fires.
- Conduct air movements for resupply.

B-3. DEFENSIVE OPERATIONS

During defensive operations, the speed and mobility of aviation assets can help maximize concentration and flexibility.

a. **Area Defense**. During an area defense, aviation assets can support the ground maneuver commander's preparation and defensive efforts. The TF commander may employ aviation to--

- Attack to fix enemy forces in the security zone.
- Screen during ground movement.
- Conduct reconnaissance, counterreconnaissance, and security operations, especially at night.
- Conduct air movement operations.
- Conduct CASEVAC operations.
- Emplace minefields using the Volcano mine system.
- Enhance C2 by providing an air mobile platform for the TF commander.
- Provide pinpoint laser guidance for artillery fires.
- Conduct air movements for resupply.

b. **Mobile Defense**. During a mobile defense, aviation assets can work in conjunction with ground maneuver forces to create a more lethal striking force to bring simultaneous fires to bear upon the enemy from unexpected directions. In a mobile defense, the TF commander may employ aviation to--

- Attack to fix enemy forces in the security zone.
- Screen during ground movement.
- Conduct reconnaissance, counterreconnaissance, and security operations, especially at night.
- Conduct air movement operations.
- Conduct CASEVAC operations.
- Emplace minefields using the Volcano mine system.

- Enhance C2 by providing an air mobile platform for the TF commander.
- Provide pinpoint laser guidance for artillery fires.
- Conduct air movements for resupply.

B-4. RECONNAISSANCE AND SECURITY OPERATIONS

Reconnaissance operations are conducted to obtain information about the enemy or the physical makeup of a particular area by visual or other detection methods. Successful reconnaissance collects quick, accurate information about the enemy and terrain. The purposes of security operations are to provide early and accurate warning of enemy operations, to provide the protected force with time and maneuver space to react to the enemy, and to develop the situation to allow the commander to employ the protected force effectively. The TF may conduct these operations to the front, flanks, or rear of a larger force. Security operations provide reaction time, maneuver space, and protection to the main body.

a. **Reconnaissance Operations**. The use of mounted, dismounted, and aerial techniques designed as part of a focused collection effort greatly enhances reconnaissance operations. Integrated air and ground reconnaissance operations provide not only an increased tempo in reconnaissance efforts but also provide the ground maneuver commander with depth and flexibility he might not otherwise have. Aviation assets support the collection effort by conducting route, zone and area reconnaissance for the ground maneuver commander.

(1) ***Route Reconnaissance***. A route reconnaissance may be conducted to gain information on a specific route or axis of advance that is important to the commander's scheme of maneuver. The TF commander may employ aviation assets alone or in conjunction with TF scouts or other ground forces to conduct a route reconnaissance. Aviation assets greatly enhance the speed at which information is processed on the capability and security of routes so that they can be utilized to support combat operations. Integration of ground forces with aviation forces enables the TF commander to gain information on numerous routes in an expedited manner.

(2) ***Zone Reconnaissance***. Since a zone reconnaissance is a directed effort to obtain detailed information concerning all routes, obstacles, terrain, and enemy forces within a defined zone, the TF commander may employ aviation assets to support a zone reconnaissance. During a zone reconnaissance, the TF commander may form air-ground teams with TF scouts to conduct operations. The aviation assets can accelerate the reconnaissance by reconnoitering any open terrain, reconnoitering forward of moving ground forces, screening the flank of ground maneuver forces, or orienting totally on finding, fixing, and destroying enemy forces. Employing aviation assets to support zone reconnaissance operations frees TF scouts to focus on close terrain, routes, and reconnaissance of obstacles and enemy. When air and ground force efforts are integrated, the TF commander is capable of developing the situation much faster than without.

(3) ***Area Reconnaissance***. An area reconnaissance is conducted to gain information on a specific area that may be critical to combat operations. Like the zone reconnaissance, the TF commander may employ air-ground teams to accomplish this task. The TF commander may assign one specific area to each separate ground and air team or he may assign them an area together. The area reconnaissance proceeds much faster than the zone reconnaissance since the efforts focus on specific pieces of terrain.

b. **Security Operations**. Security operations allow the ground maneuver commander to gain information about the enemy and to provide reaction time, maneuver space and protection of friendly forces. This allows the ground maneuver commander to preserve valuable combat power that he can employ to destroy the enemy. Aviation assets support the TF commander by conducting screen and guard operations.

(1) ***Screen***. During screening operations, the ground maneuver commander may employ aviation assets alone or in conjunction with ground forces to provide early warning, cover any exposed flanks, or fill any gaps between maneuver forces that cannot be secured in force. Because of the capabilities of aviation assets, especially at night, the TF commander can judiciously employ them on the battlefield to cover a very large area that cannot be covered on the ground alone. Additionally, aviation assets enable the TF commander to respond to developing enemy situations in an expeditious manner.

(2) ***Guard***. During guard operations, aviation assets must be task-organized with ground maneuver assets such as a company/team conducting a counter-reconnaissance mission. Aviation assets support the TF commander by providing the same capabilities as with screen operations. During guard operations, the TF commander may utilize aviation assets to conduct reconnaissance, screen an exposed flank during movement, enhance C2, provide direct and indirect fire support, and position CS and CSS assets for future use.

c. **Available assets**. Any rotary-wing aircraft can conduct reconnaissance operations since they all greatly increase the range at which enemy movement can be detected. However, the two aircraft primarily dedicated to reconnaissance and security operations are the AH-64 Apache and OH-58D.

(1) ***AH-64 Apache***. The AH-64A is a twin-engine, tandem-seat, four-bladed attack helicopter with a crew of two rated aviators. The pilot occupies the rear cockpit, and the copilot-gunner occupies the front cockpit. The aircraft has day, night, and limited adverse weather fighting capabilities. The aircraft is equipped with a laser rangefinder/designator (LRF/D). The LRF/D is used to designate for the firing of a Hellfire missile and provides range-to-target information for the fire control system. (See FM 1-112 for a detailed explanation of the aircraft.)

(2) ***AH-64D Longbow Apache***. The AH-64D is a variant of the AH-64A. The AH-64D is designed to provide increased effectiveness over the capabilities of the AH-64A while greatly reducing the AH-64A's limitations. The AH-64D has several key improvements, including fire control radar (FCR), radio frequency (RF) Hellfire (fire and forget) missile system, digital communications, and other significant features. The day, night, and limited adverse weather fighting capabilities of the AH-64A are significantly enhanced in the AH-64D.

(3) ***OH-58D Kiowa Warrior***. The OH-58D(I) Kiowa Warrior provides the maneuver commander with a versatile platform; it can be armed with various weapons systems and is suitable for employment in numerous types of situations and operations. The aircraft features a stabilized mast-mounted sight (MMS) with a low-light television sensor (TVS), thermal imaging sensor (TIS), and LRF/D. The aircrew of the Kiowa Warrior can detect a heat source in day or night conditions at a range of up to 15 kilometers and can provide laser designation of targets for laser-guided munitions.

(4) Maximum weapon ranges specified in Table B-1 are based on "best-case" function of the system. Maximum ranges should not be the only criteria used in the establishment of engagement areas to battle positions, attack by fire (ABF), or support by fire (SBF) positions. Ranges to target engagement distances are affected by the factors of METT-TC, and the single most important factor is weather because of the limiting impact on visibility and thermal sensors. Examples of some normal engagement weapon ranges are listed below:

Hellfire: 1000 to 6000 meters (day)
1000 to 4000 meters (night)
Rocket: 1000 to 6000 meters
30mm: 500 to 3000 meters
.50 cal: 500 to 1500 meters

Aircraft Type *	Hellfire	2.75" (70mm) Rockets	.50 caliber machine gun (rounds)	20mm cannon (rounds)	30mm Chaingun (rounds)
AH-64A/D	16	76			1,200
OH-58D **	4	14	500		
MAX RANGE	8 km	8 km	2 km	2 km	4 km

NOTES: * Numbers in each column indicate the maximum load for each system. The total amount of ordnance carried will vary based on METT-TC and selected weapon configuration.
** One weapon system per side for Hellfire and 2.75-inch rocket.

Table B-1. Rotary-wing aircraft.

B-5. RETROGRADE OPERATIONS

During retrograde operations, aviation assets can assist the TF commander in movement away from an enemy force or to the rear.

a. **Delay**. In a delay operation, the TF commander trades space for time and preserves friendly combat power while inflicting maximum damage on the enemy. Aviation forces can assist by--

- Rapidly concentrating fires to allow disengagement and repositioning.
- Conducting surprise attacks to confuse advancing enemy forces.
- Emplacing Volcano minefields to supplement obstacles or to impede or canalize enemy movements.
- Conducting air assaults to move ground forces between delaying positions.
- Providing a C2 platform.

b. **Withdrawal**. During a withdrawal, the TF commander voluntarily disengages the enemy. This withdrawal may be conducted with or without enemy pressure. Aviation forces can assist the ground maneuver commander in a withdrawal by--

- Using attack helicopters in an offensive manner to attrit enemy maneuver and fire support units.
- Providing security for withdrawing friendly units.
- Acting as the reserve.
- Conducting CASEVAC operations.
- Emplacing ROM sites to refuel vehicles conducting the retirement.
- Providing a C2 platform.

B-6. AIR-GROUND INTEGRATION

Direct fire aviation missions in the close fight differ greatly from engagements in a cross-FLOT operation. In a cross-FLOT operation, attack and cavalry aircraft can benefit from deliberate planning, freely engaging at maximum ranges with minimal concern of fratricide. Engagements in the close fight, on the other hand, often result in engagements within enemy direct-fire weapons system ranges that are in close proximity to friendly units. The hasty attack in the close fight typically lacks proper coordination between air and ground elements. The following paragraphs focus on the hasty attack within an air-ground integrated attack. Effective coordination between ground maneuver units and attack aviation maximizes the capabilities of the combined arms team while minimizing the risk of fratricide. The following major problem areas contribute to inadequate or ineffective air-ground integration:

- Aircrews' lack of understanding of the ground tactical plan or the TF commander's intent.
- Lack of common control measures that allow both air and ground units maximum freedom of fire and maneuver.
- Lack of methods of differentiating between enemy and friendly forces on the ground.

B-7. AIR-GROUND COORDINATION PROCEDURES

Effective integration of air and ground assets begins with the supported TF element. When the aviation brigade or task force receives a mission to provide assistance to a ground unit engaged in close combat and planning time is minimal, the initial information provided by the unit in contact should be sufficient to get the aviation attack team out of the aviation tactical assembly area to a holding area in order to conduct direct coordination with the engaged maneuver unit. To ensure the air and ground forces exchange essential information, planners use a five-step procedure. The five major steps are maneuver brigade planning requirements, battalion close fight SITREP, attack team check-in, coordination for aviation close fires (ACF), and battle damage assessment and reattack. Since aviation assets are normally in a direct support role to the brigade, the TF S-3 air must conduct close coordination with the brigade S-3 air when requesting aviation support. This paragraph also discusses aviation employment considerations and maneuver brigade liaison officer coordination requirements.

a. **Step 1, Maneuver Brigade Planning Requirements**. The maneuver brigade, through its aviation liaison officer, provides the necessary information to meet planning requirements to the aviation brigade headquarters (Table B-2, page B-8). The initial planning and information to be passed to the aviation brigade headquarters includes the location of the holding area, air axis, and route or corridor for entry and exit through the brigade and battalion sector. The holding area should be in the sector of the TF involved in close combat. The holding area may be a concealed position or an aerial holding area that allows for final coordination between the attack team leader and the ground unit leader. It must be located within FM radio range of all units involved. Alternate holding areas, along with ingress and egress routes, must be designated if occupation is expected to last longer than 15 minutes. The ground maneuver task force S-3 air also provides the call signs and frequencies or SINCGARS hopsets and COMSEC information regarding the battalion in contact. In addition, the ground maneuver task force S-3 air provides a

current situation update for its AO and specifically for the supported company teams in the AO. This update includes a recommended engagement area that will allow for initial planning for battle positions, or attack by fire positions, or support by fire positions and possibly prevent unintentional overflight of enemy positions.

MINIMUM PLANNING REQUIREMENTS
1. **Current situation:** This should include friendly forces location and situation, enemy situation highlighting known ADA threat in the AO, and tentative engagement area coordinates.
2. **Brigade or battalion level graphics update:** This can be via MCS-P or radio communications. It updates critical items such as LOA, fire control measures, and base maneuver graphics to facilitate better integration into the friendly scheme of maneuver.
3. **Fire support coordination information:** This includes call signs and frequencies and locations of DS artillery and organic mortars.
4. **Ingress and egress routes into their AO:** This includes PPs into sector or zone and air routes to the holding area.
5. **Holding area for face-to-face coordination between the attack team and the TF in contact:** A holding area equates to an assault position. It must be out of enemy mortar range, out of range of enemy direct fire systems, and adequate in size to accommodate the number of aircraft assigned the mission.
6. **Call signs and frequencies of the TF in contact down to the company in contact:** Air-ground coordination on command frequencies is necessary to provide information for all elements involved.
7. **SINCGARS:** Synchronize time.

Table B-2. Minimum planning requirements.

b. **Step 2, Task Force Close Fight SITREP**. En route to the holding area, the attack team leader contacts the ground maneuver TF on its FM command net to receive a close fight SITREP (Table B-3). This SITREP verifies the location of the holding area and a means to conduct additional coordination. The attack team leader receives an update from the ground maneuver TF on the enemy and friendly situations. The TF also verifies frequencies and call signs of the unit in contact. By this time, the TF S-3 air has contacted the company team commander in contact to inform him that attack aviation is en route to conduct a hasty attack.

1. **Enemy situation:** focusing on ADA in the AO, type of enemy vehicles/equipment position (center mass) and direction of movement if dispersed provide front line trace.

2. **Friendly situation:** location of company in contact, mission assigned to them, method of marking their position.

3. **Call sign and frequency verification.**

4. **Holding area verification:** if intended to be used for face-to-face coordination, a sign counter sign must be agreed upon i.e. using a light/heat source to provide a recognizable signature, answered by either aircraft IR lights or visible light flashes to signify which aircraft to approach.

Table B-3. Task force close fight SITREP.

NOTE: The examples of simulated radio traffic in this appendix are merely examples of what may occur.

EXAMPLE

Attack Team	**Ground Maneuver Battalion**
"Bulldog 06 this is Blackjack 26, over"	
	"Blackjack 26 this is Bulldog 06, L/C, over"
"Bulldog 06, Blackjack 26 enroute to HA at grid VQ 98454287, request SITREP, over"	
	"Blackjack 26 this is Bulldog 06, enemy situation follows, Hardrock 06 is taking direct fire from a platoon size armor element at grid VQ 96204362, Hardrock 06 elements are established on phase line Nevada center mass VQ 96000050, holding area VQ 94004000 expect radio coordination only, contact Hardrock 06 on FH 478, over"

(1) Upon receiving the required information from the TF, the aviation attack team leader changes frequency to the ground company's FM command net to conduct final coordination before ingressing on attack routes to BPs or ABF or SBF positions. Coordination begins with the ground maneuver company commander and ends with the leader of the lowest-level unit in contact.

(2) When the attack team leader conducts coordination with any key leader of the TF, the ground command net is the most suitable net on which both air and ground elements can conduct the operation. It allows all key leaders on the ground, including the TF FSO and the attack team leader and his attack crews, to communicate on one common net throughout the operation. Operating on the command net also allows the attack team to request responsive mortar fire for either suppression or immediate suppression of the enemy. The AH-64 Apache and the AH-1 Cobra are limited to only one FM radio due to aircraft configuration. However, the OH-58 is dual-FM capable, which gives the attack team leader the capability to maintain communications with the ground maneuver company, as well as the TF fire support element.

EXAMPLE

Attack Team	**Ground Maneuver Company**
"Hardrock 06 this is Blackjack 26 on FH 478, over"	
	"Blackjack 26 this is Hardrock 06, L/C over"

c. **Step 3, Attack Team Check-In**. Upon making initial radio contact with the ground maneuver unit in contact, the attack team leader executes a succinct check-in (Table B-4). This check-in includes the attack team's present location, which is normally its ground or aerial holding area; the attack team's composition; its armament load and weapons configuration; total station time; and its night-vision device capability. If not using a ground holding area due to METT-TC considerations, the attack team selects and occupies an aerial holding area within FM communications range until all required coordination is complete. The attack team leader and ground unit's key leaders must consider the effects on friendly forces of the various weapons carried by the attack aircraft prior to target selection and engagement. Weapons systems and munition selection for a given engagement depend on the factors of METT-TC. Point target weapons systems, such as Hellfire or TOW, are the preferred systems for armor or hardened targets when engaging targets in the close fight. The gun systems and the 2.75-inch rockets are the preferred systems and munitions for engaging troops in the open, soft targets such as trucks, and trenchworks. These area fire weapons systems pose a danger to friendly soldiers who may be in the lethality zone of the rounds or rockets. If this danger exists, then the leader on the ground must be very precise in describing the target he wants the aircraft to engage.

1. **Aircraft present location.**
2. **Team composition.**
3. **Munitions available.**
4. **Station time.**
5. **Night-vision device capable and type.**

Table B-4. Attack team check-in.

EXAMPLE

Attack Team	**Ground Maneuver Company**
"Hardrock 06, Blackjack 26 is currently holding at grid VQ 98454287, 2 Kiowa Warriors with 450 rounds of .50 cal, 2 Hellfires each, half hour station time, all aircraft are NVG and FLIR capable, over"	
	"Blackjack 26, Hardrock 06, stand by, over"
"Blackjack 26, roger"	

d. **Step 4, Coordination for Aviation Close Fires**. Time is the primary constraining factor for coordinating aviation close fires in the hasty attack. When possible, coordinate ACF face-to-face using the ACF coordination checklist (Figure B-1, page B-13). If time is not available for face-to-face coordination, then use radio-only communications and the request for immediate ACF. The request for immediate ACF may also be used when targets of opportunity require engagement through a target handoff between the ground and aviation elements after face-to-face coordination has been conducted. Although face-to-face coordination is preferred, the factors of METT-TC dictate how the commander in contact and the attack team leader conduct coordination. A major benefit of face-to-face coordination is the attack team's ability to talk to the ground commander with a map available and integrate into the ground scheme of maneuver. This also provides an opportunity for the attack team to update its maps with the maneuver TF's latest graphics.

(1) ***Face-to-Face Coordination***. Once they receive the flight check-in, the ground company commander and attack team leader meet at the holding area and use the ACF coordination checklist to plan their attack (Figure B-1, Page B-13).

(a) There are several key elements of coordination to complete at the holding area:

- The target must be identified and its activity explained.
- The friendly forces positions must be identified on a map with a method of visually marking those positions passed on to the flight.

- If not previously done, the engagement area must be verified or defined.
- After defining the engagement area, the attack team leader must establish BPs and SBF positions.
- The scheme of maneuver for the ground elements must be explained with a commander's intent and description of what is considered the decisive point on the battlefield. With that information, the attack team provides an integrated scheme of maneuver.
- Existing or required fire control measures must be planned for and utilized to minimize the potential for fratricide.
- Key maneuver graphics that are required to support or understand the scheme of maneuver are passed between the ground commander and attack team leader.
- A method of marking targets, such as laser pointers and tracers, must be discussed.

(b) After completing this coordination, forces can execute the synchronized attack plan. Even with carefully thought out plans, however, situations will arise during the attack that will require flexibility and possibly the need to mass effects against targets of opportunity at a new location within the supported units sector or zone. Ground and air forces attack these targets of opportunity on a case-by-case basis using the request for immediate ACF. (See FM 1-111.)

(c) Ground and air commanders must consider the time available for this coordination. If they remain in the holding area for greater than 15 minutes, they must accept increased risk of holding area compromise. The factors of METT-TC dictate the extent of preplanning they can accomplish and the length of time they should occupy the holding area.

(2) ***Radio-Only Communications Coordination***. When using radio-only communications coordination, leaders use a request for immediate ACF (FM 1-111). As previously discussed, leaders employ immediate ACF under two different conditions. The first is when they have already conducted face-to-face coordination and targets of opportunity arise. In this case, the ground element uses a request for immediate ACF for target handoff. The second condition is when time is not available for face-to-face coordination. In this case, the request for immediate ACF may be used as a stand-alone method of engagement where the call is used for communicating attack requirements from ground to air via radio only.

(a) When employing the request for immediate ACF under the first condition, it is assumed that air and ground units have exchanged all essential elements from the coordination checklist during face-to-face coordination at the holding area. During the attack, the TF or company commander calls the attack team leader and requests immediate ACFs for targets of opportunity. In this manner, the forces accomplish target handoff and the attack team leader redistributes fires accordingly.

(b) When employing the request for immediate ACF under the second condition, the ground commander in contact should brief only essential elements from the ACF coordination checklist as a SITREP via radio. He transmits this SITREP prior to a request for immediate ACF. Once he receives the flight check-in, the ground maneuver leader then provides a situation update, METT-TC permitting, containing essential elements from the ACF coordination checklist. After sending the SITREP, the ground commander

calls the attack aircraft forward from their holding area or aerial holding area using a request for immediate ACF. Whether the attack team utilizes a holding area or aerial holding area to conduct radio coordination depends on its abilities to maintain FM communication with the ground element in contact. As the attack team maintains position at an aerial holding area or within a holding area, the ground maneuver leader succinctly outlines the concept of his ground tactical plan. This includes updates on enemy composition, disposition, and most recent activities, particularly the location of air defense weapons. He also provides an update on the friendly situation to include the composition, disposition, and location of his forces and supporting artillery or mortar positions. After providing this information, the ground maneuver leader uses the request for immediate ACF format for attack and for subsequent re-attacks.

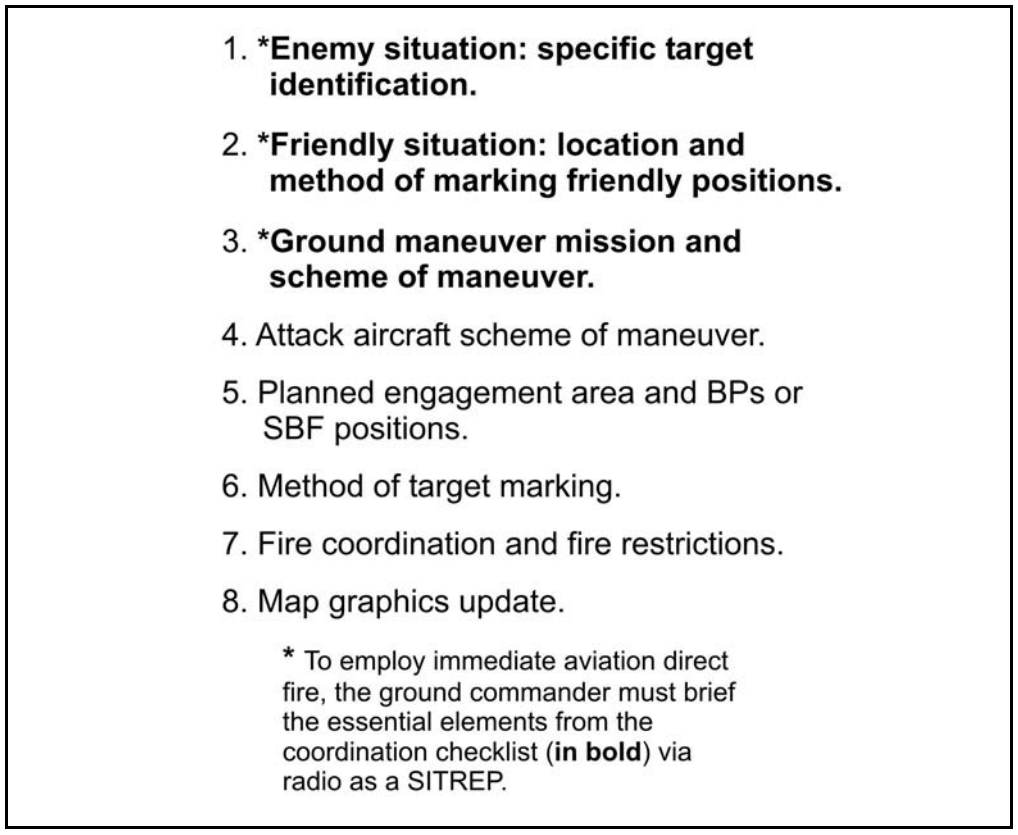


Figure B-1. Aviation close fires coordination checklist.

(c) After receipt of a request for immediate ACF, the attack team leader informs the ground unit leader of the battle position, support-by-fire position, or the series of positions his team will occupy. These are the positions that provide the best observation and fields of fire into the engagement or target area. The battle position or SBF position is the position from which the attack aircraft will engage the enemy with direct fire. It includes a number of individual aircraft firing positions and may be planned in advance or established as the situation dictates. Its size varies depending on the number of aircraft using the position, the size of the engagement area, and the type of terrain. The battle position or SBF position is normally offset from the flank of the friendly ground position, but close to the position of the requesting unit to facilitate efficient target handoffs. This

also ensures that rotor wash, ammunition casing expenditure and the general signature of the aircraft does not interfere with operations on the ground. The offset position also allows the aircraft to engage the enemy on its flanks rather than its front and lessens the risk of fratricide along the helicopter gun target line.

(d) The attack team leader then provides the ground maneuver unit leader with his concept for the team's attack on the objective. This may be as simple as relaying the attack route or direction from which the aircraft will come, the time required to move forward from their current position, and the location of the BP. Only on completion of coordination with the lowest unit in contact does the flight depart the holding area for the battle position. As the attack team moves out of the holding area, it uses nap of the earth (NOE) flight along attack routes to mask itself from ground enemy observation and enemy direct fire systems. The attack team leader maintains FM communications with the ground maneuver unit leaderwhile he maintains internal communications on either his VHF or UHF net.

e. **Step 5, Battle Damage Assessment and Reattack**. After completing the requested ACF, the attack team leader provides a BDA to the TF commander. Based on his intent, the TF commander determines if a reattack is required to achieve his desired end state. Requests for ACF may continue until all munitions or fuel is expended. Upon request for a reattack, the attack team leader must consider the effects on duration and strength of coverage he can provide the ground maneuver commander. The attack team may need to devise a rearming and refueling plan, maintaining some of his aircraft on station with the unit in contact while the remainder returns to the FARP. Beyond the coordination with the ground maneuver unit in contact, the attack team leader must coordinate this effort with his higher headquarters.

B-8. REVIEW OF MAJOR POINTS

In review, when an attack unit integrates into the ground scheme of maneuver, mission success requires detailed coordination between the attack unit and the ground unit already engaged in close combat.

a. The maneuver brigade provides the aviation brigade or task force with the information available on locations, routes, and communications before the attack team's departure from its assembly area.

b. The holding area is a concealed position where final coordination is made with the unit in contact before the attack team launches its attack. The aerial holding area is a point in space within the ground battalion's AO that is oriented towards the enemy to allow the attack team to receive requests for ACF and expedite the attack. The aerial holding area may be an alternate BP positioned outside the enemy's direct and indirect fire weapons ranges.

c. The attack team coordinates directly with the lowest level unit in contact. The preferred method of coordination is face-to-face; however, due to time constraints, radio coordination on the ground company FM command net may be the only method allowable.

d. The ground maneuver leaders and attack pilots must understand the ground effects of the attack team's weapons systems.

e. Final coordination with the ground maneuver unit includes agreeing on a method of identifying the friendly and enemy positions.

f. The means of identifying friendly positions should take advantage of the FLIR, TIS, and night-vision goggle (NVG) capabilities of the attack team.

g. The battle position or ABF position should be offset from the ground maneuver unit to maximize the effects of its weapons and to minimize the risk of fratricide. The ground commander should inform DS artillery and organic mortars of these positions in order to deconflict indirect fires into his sector or zone.

h. After completion of the ACF, the attack team leader provides a BDA report to the ground maneuver commander.

B-9. EMPLOYMENT CONSIDERATIONS

All aircrew and ground maneuver leaders should understand the strengths and weaknesses of available aviation sensors when employed in conjunction with target-marking equipment. This paragraph addresses several factors that operators should consider when marking targets for varied aviation optics. The equipment covered includes target-marking devices, NVGs, FLIR, TIS, TV/electrooptical (EO), electronic beacons, and laser designators.

a. **Target Identification and Friendly Position Marking**. The method of marking friendly positions is a critical piece of planning that must be considered thoroughly regardless of time available to the ground and air commanders. The ability of the aircrews to observe and identify ground signals easily is a critical factor in reducing fratricide and maximizing responsive aerial fires. The signal or combination of signals must be based on items commonly carried by ground maneuver units, must be acquirable by the night-vision or thermal imaging systems on the aircraft, and must be recognizable by the aircrew.

(1) Determine all required identification and marking procedures before starting a mission. Accurate and detailed maps, charts, or imagery facilitates aircrew orientation to the friendly scheme of maneuver. Aircrews must continue to work closely with the ground forces to identify friendly positions positively.

(2) Visual signaling or marking positions helps determine the disposition of friendly forces. Often, the simplest methods are the best. Traditional signaling devices, such as flares, strobes, and signaling mirrors, may be quite effective. Target marking, or orientation on enemy positions, may also be accomplished by signaling. Common techniques include the use of smoke, laser pointers, or tracers. Other devices are available to aid in the recognition of friendly forces and equipment where the fluid tactical situation and intermingling of forces in the close fight may make identification difficult. The use of glint tape, combat identification panels (CIPs), and infrared beacons assists in the clear identification of friendly ground forces, but ground lighting, thermal contrast, and intermediate obstructions influence the effectiveness of these devices.

(3) The proximity of friendly forces to targets requires positive identification and makes marking of friendly units and targets critical. All participants must clearly understand the procedures and be issued the appropriate devices. The fire support assets must also be familiar with the friendly marking system. Aircrews require positive identification of the target and friendly positions prior to firing. The methods to mark and identify targets are limited only by the creativity of the ground forces and aircrews. Commanders should use Table B-5, page B-17, as a reference but not limit themselves to only these methods. Methods employed must be adapted to the conditions prevalent at the

time. Positive air-to-ground communications are essential to coordinate and authenticate marks.

(4) Time permitting, attack aircraft may input a target grid into the aircraft GPS or inertial navigation system (INS). The target grid can provide fire control cues (range, heading, and time to the target) to aid in quicker target acquisition and help distinguish friendly from enemy. Because ACF missions may be "danger close" with short firing ranges, tracking time is minimal and therefore so is the time available to optimize the sensor.

METHOD	DAY/ NT	ASSETS	FRIENDLY MARKS	TARGET MARKS	REMARKS
SMOKE	D/N	All	Good	Good	Easily identifiable. May compromise friendly position, obscure target, or warn of fire support employment. Placement may be difficult due to structures.
SMOKE (IR)	D/N	All/NVD at night	Good	Good	Easily identifiable. May compromise friendly position, obscure target, or warn of fire support employment. Placement may be difficult due to structures. Night marking is greatly enhanced by the use of IR reflective smoke.
ILLUM GRND BST	D/N	All	N/A	Good	Easily identified, may wash out NVDs.
SIGNAL MIRROR	D	All	Good	N/A	Avoids compromise of friendly location. Dependent on weather and available light and may be lost in reflections from other reflective surfaces (windshields, windows, water, etc.).
SPOT LIGHT	N	All	Good	Marginal	Highly visible to all. Compromises friendly position and warns of fire support employment. Effectiveness depends on degree of urban lighting.
IR SPOT LIGHT	N	All NVD	Good	Marginal	Visible to all with NVGs. Less likely to compromise than overt light. Effectiveness depends on degree of urban lighting.
IR LASER POINTER (below .4 watts)	N	All NVG	Good	Marginal	Effectiveness depends on degree of urban lighting.
IR LASER POINTER (above .4 watts)	N	All NVD	Good	Good	Less affected by ambient light and weather conditions. Highly effective under all but the most highly lit or worst weather conditions. IZLID-2 is the current example.
VISUAL LASER	N	All	Good	Marginal	Highly visible to all. Risk of compromise is high. Effectiveness depends on degree of urban lighting.
LASER DESIG-NATOR	D/N	PGM- or LST-equipped	N/a	Good	Highly effective with PGM. Very restrictive laser acquisition cone and requires line of sight to target. May require pre-coordination of laser codes.
TRACERS	D/N	All	N/a	Marginal	May compromise position. May be difficult to distinguish mark from other gunfire. During daytime use, may be more effective to kick up dust surrounding target.
ELECTRONIC BEACON	D/N	See remarks	Excellent	Good	Ideal friendly marking device for AC-130 and some USAF fixed-wing aircraft (not compatible with Navy or Marine aircraft). Least impeded by urban terrain. Can be used as a TRP for target identification. Coordination with aircrews essential to ensure equipment and training compatibility.
STROBE (OVERT)	N	All	Marginal	N/A	Visible by all. Effectiveness depends on degree of urban lighting.
STROBE (IR)	N	All NVD	Good	N/A	Visible to all NVDs. Effectiveness depends on degree of urban lighting. Coded strobes aid in acquisition.
FLARE (OVERT)	D/N	All	Good	N/A	Visible to all. Easily identified by aircrew.
FLARE (IR)	N	All NVD	Good	N/A	Visible to all NVDs. Easily identified by aircrew.
GLINT/IR PANEL	N	All NVD	Good	N/A	Not readily detectable by enemy. Very effective except in highly lit areas.
COMBAT IDENTIFICA-TION PANEL	D/N	All FLIR	Good	N/A	Provides temperature contrast on vehicles or building. May be obscured by urban terrain.
VS-17 PANEL	D	All	Marginal	N/A	Only visible during daylight. Easily obscured by structures.
CHEMICAL HEAT SOURCES	D/N	All FLIR	Poor	N/A	Easily masked by urban structures and lost in thermal clutter. Difficult to acquire. Can be effective when used to contrast cold background or when aircrew knows general location.
SPINNING CHEM-LIGHT (OVERT)	N	All	Marginal	N/A	Provides unique signature. May be obscured by structures. Provides a distinct signature easily recognized. Effectiveness depends on degree of urban lighting.
SPINNING CHEM-LIGHT (IR)	N	All NVD	Marginal	N/A	Provides unique signature. May be obscured by structures. Effectiveness depends on degree of urban lighting.

Table B-5. Target and friendly marking methods.

b. **Laser Designation**. A major challenge for a gunner is achieving and keeping line of sight with a target or friendly position from a moving aircraft. Helicopters may use hover capabilities but only in the most permissive environments. Laser designation requires uninterrupted LOS to identify and engage a target. This may mean the lasing platform must be very near the target--possibly within enemy direct fire ranges, danger-close distances, or weapon arming distances--to keep the spot on the target until ordnance impact, especially in complex (urban) terrain. Smoke from burning vehicles or other fires may drift across the laser to the target line causing laser dispersion. Most laser designating platforms cannot actually see their laser spot on a target. Lasers are often boresighted to other supporting sensors like FLIR/TIS or TV/EO. If the supporting sensor cannot see a target, the laser cannot effectively mark the target. Further, even though a FLIR/TIS may "see" a target, the laser may not be capable of guiding ordnance against it since smoke, invisible to the FLIR/TIS, may attenuate the laser energy. The most significant contributor to laser attenuation, or nonselective scattering, is water vapor or absolute humidity. The impact of humidity on FLIR/TIS performance is greater than its impact on the laser. In other words, if you can detect the target in clear air then the laser should provide sufficient laser energy for seeker acquisition. As a rule of thumb, if you detect a target with a visual sensor and consistently determine a range to it with a laser range finder, then you can likely designate it satisfactorily for a laser-guided weapon. For low and medium threats where a great amount of time is available to use the FLIR/TIS to point the laser, the methods are simple. As the threat escalates and the time available for target acquisition shrinks, targeting with the FLIR/TIS becomes more difficult, and the delivery accuracy of the laser munitions may be degraded significantly.

c. **Television/Electro-Optical.** TV/EO sensors are subject to many of the same limitations as the naked eye, particularly TVS with no low-light capability. Aircrews may not be successful in acquiring a target and achieving lock-on if smoke, buildings, or other factors repeatedly interrupt line of sight. Low-light or all-light TV/EO sensors may require frequent gain and filter changes to accommodate varying light levels. Normal means of target and friendly identification may prove ineffective. Infrared strobes or even overt strobes normally visible to TV/EO sensors may be lost in the light clutter. Laser pointers will suffer the same type of degradation. TV/EO resolution is typically not sufficient at medium and extended ranges to discriminate between a friendly position or a target and its surrounding features. Ground personnel may need to utilize more aggressive and overt means of identifying their position and that of the target if TV/EO sensors are to be used to identify, track, and engage targets.

B-10. TASK FORCE S-3 AIR PLANNING REQUIREMENTS

The following list is not all-inclusive but further defines the TF S-3 air planning requirements in support of aviation integration in the close fight. Many of these requirements require the assistance of the maneuver task force staff. Proper planning requires the integration of the brigade and its associated direct support aviation brigade headquarters or task force as early as possible in the MDMP.

a. Coordinate airspace usage and control with the TF S3, maneuver brigade S3, FSO, and ADA platoon leader.

b. Coordinate for land usage within the TF area of operations for possible forward assembly areas, holding areas, and forward arming and refueling points.

c. Coordinate for SEAD.

d. Ensure that the TF commander understands the number of aviation assets available and duration of coverage provided. If required to support the operation, begin coordination to ensure a FARP is available to support the mission.

e. Provide the aviation unit with the most current update on the enemy situation, with additional emphasis on air defense assets.

f. Provide the aviation unit with fire support assets (not just SEAD) available. Provide call signs, frequencies, priorities of targets, and any special instructions.

g. Coordinate air routes into the TF AO and FLOT-crossing procedures in both directions if required (passage points [PPs], alternate PPs, crossing times, SEAD windows, altitudes, and airspeeds).

h. Ensure that the TF commander is briefed on fighter management considerations.

i. Coordinate for COMSEC, Have Quick sequences (through the ALO) and IFF fills. Ensure that changeover times are the same between supporting and supported units and that both elements understand the communications requirements, capabilities, and limitations of the other.

j. Ensure method of target marking and friendly position marking is passed to aviation brigade LNO.

k. Prepare a mission statement for the aviation attack unit to include the target, target location, and the expected results of the attack (destroy, attrit, disrupt, overmatch, or deny or delay avenue of approach).

l. Designate an axis of advance, separate from the TF's axis, for each attack helicopter unit.

m. Coordinate for establishment and protection of BPs or ABF positions. To take advantage of helicopter mobility, battle positions should be planned for rear and flank shots into engagement areas, if possible. LNOs should not attempt to pick individual firing positions but should use the guidelines in the acronyms BRASSCRAF and NORMA (Appendix A, FM 1-112) to select BPs in conjunction with the aviation brigade or task force staffs.

n. Coordinate for fire control in engagement areas. Establish target priorities for attack helicopters. Inform the TF commander that by doctrine, the target priorities for any attack helicopter are (in order):

- Immediate threat to self.
- Immediate threat to platoon or company.
- Immediate threat to other friendly forces.
- Pre-established target priorities.

o. Coordinate laser codes, especially when working with compatible nonaviation laser systems (Copperhead, GLAD, Pave Penny, Maverick, and laser-guided bombs).

B-11. ARMY AVIATION MANEUVER SUPPORT IN URBAN OPERATIONS

Effective combined arms employment in UO requires that aviation and ground maneuver forces synchronize their operations by operating from a common perspective. This paragraph highlights some possible procedures that will aid in creating a common air-ground perspective.

a. **General.** Army aviation’s primary role during UO is the support of the shaping operations. Aviation operating on the urban periphery effectively enhances isolation,

reconnaissance, resupply, troop movement, evacuation, and support by fire for ground forces. Army aviation also enhances the combined arms team's ability to quickly and efficiently transition to new missions. Aviation forces normally avoid operations in urban terrain due to the high risk of being engaged by enemy forces in close proximity. When aviation forces cannot avoid urban areas during UO, special measures and thorough risk analysis must be conducted to minimize the associated dangers. The following framework is used to visualize urban operations.

(1) ***Assess.*** Identify the portion(s) of the urban area essential to mission success. Aviation forces provide reconnaissance capability, security to ground forces, movement of troops and supplies, and augmentation of communication and surveillance capabilities.

(2) ***Shape.*** Isolate those areas essential to mission success or avoid isolation while in the defense. In the offense, aviation forces attack to isolate the objective, move troops and supplies, enhance C2, conduct reconnaissance, and augment ground forces. In the defense, aviation forces act as a maneuver element to set the conditions for the main battle and prevent isolation.

(3) ***Dominate.*** Precisely mass the effects of combat power to rapidly dominate the area. Army aviation supports the ground maneuver commander's intent and scheme of maneuver by providing maneuver and support assets. Aviation supports the combined arms effort by providing support by fire, movement of troops and supplies, enhanced C2, air assaults, reconnaissance, and continued isolation of the objective.

(4) ***Transition.*** Transition the urban area to the control of another agency and prepare for follow-on operations. Aviation forces conduct combat, combat support, and combat service support missions that facilitate the combined arms transition to follow-on operations.

b. **Command and Control.** Army aviation forces may be employed organic to a division or higher level of command to conduct maneuver or provide support (DS or GS). Aviation forces may also be attached or under operational control of another command. Operational control of attack helicopter units will remain at the level of battalion or higher; however, attack helicopters may conduct direct air-to-ground coordination with companies and platoons during combat operations.

c. **Maneuver Graphic Aids.** One of aviation's greatest strengths--its ability to maneuver three dimensionally--can also be a detriment. The associated challenge is that aircrews have different visual cues and perspectives than do ground forces. Common graphics and sketches can help alleviate these differences. A network route structure of air control points (ACP) and routes (preferably surveyed) may be used to facilitate route planning, navigation, and C3. Sketches help correlate air and ground control measures with predominate urban features. The area sketch offers the ground commander and the aircrew a means of identifying friendly and enemy locations for planning and coordination (Figure B-2). The area sketch is best used for smaller towns and villages but can be applied to a certain engagement area or specific area of operations in a larger city. The area sketch captures the natural terrain features, manmade features, and key terrain in that area and designates a letter or numeral code to each. Buildings are coded and each corner of the building is coded. This gives the aircrews an accurate way to target specific buildings as requested by the ground unit commander or to identify friendly locations. Inclusion of maneuver graphics, fire support control measures, and airspace control measures allows aircrews and maneuver elements to better visualize the urban portion of

the battlespace. Units must ensure they use the same area sketch for accurate coordination.

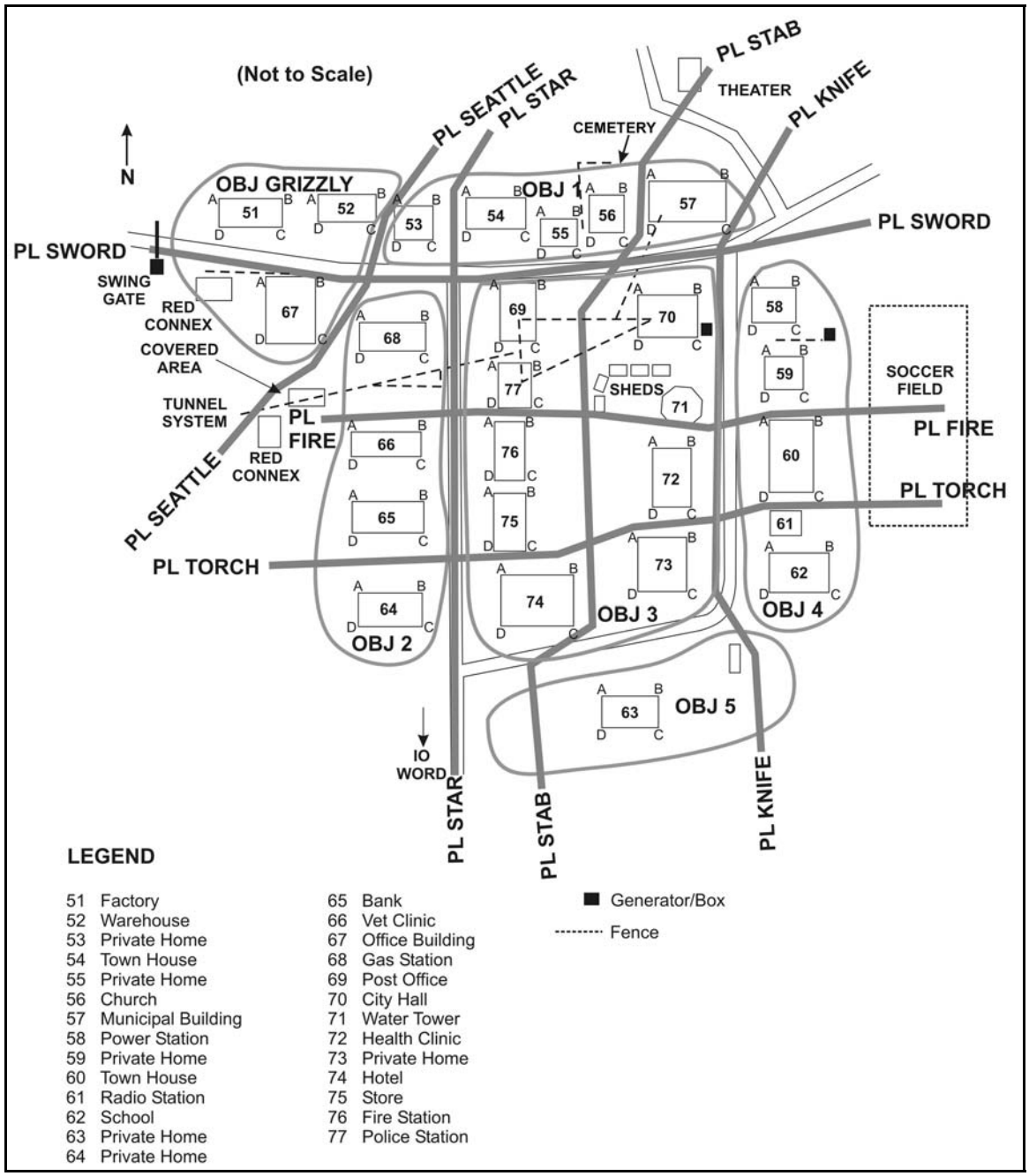


Figure B-2. Area sketch (simplified).

d. **Identifying Friendly Positions, Marking Locations, and Target Acquisition.** In the urban environment friendly, enemy, and noncombatants may operate in close vicinity. Furthermore, structures and debris can cause problems with identifying precise locations. Reliable communication is essential to ensure aircrews know the locations of all participants in UO. To further enhance air-ground coordination, methods must be

established to allow aircrews to visually identify key locations. See Table B-5, page B-17, for methods of marking.

(1) ***Targeting Grids and Reference Techniques.*** Ground maneuver elements generally use a terrain-based reference system during urban operations. The militarly grid reference system (MGRS) coordinates have little meaning at street level. Common control methods include urban grid (Figure B-3), bull's-eye/checkpoint targeting (Figure B-4), objective area reference grid (Figure B-5), and TRPs (Figure B-6). These techniques are based on the street and structure pattern present, without regard to the MGRS grid pattern. Aircrews must plan to transition to the system in use by the ground element upon arrival in the objective area. For example, references to the objective or target may include local landmarks such as, "The third floor of the Hotel Caviar, southeast corner." This transition should be facilitated by using a "big to small" acquisition technique.

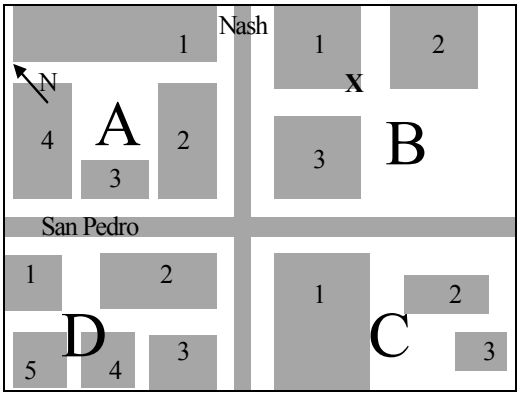


Figure B-3. Urban grid.

Bravo-1, south corner. Sniper top floor window."

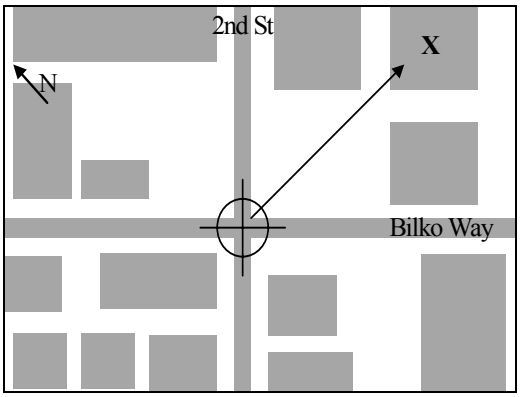
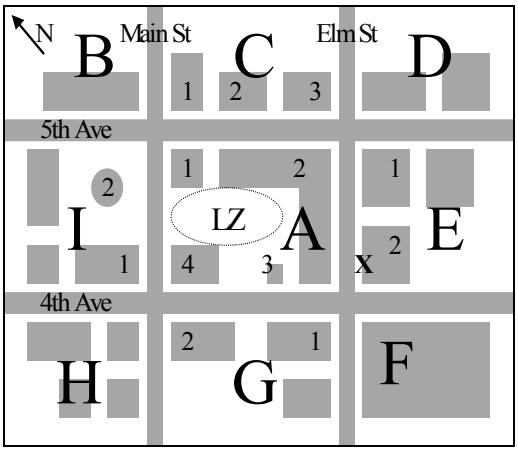


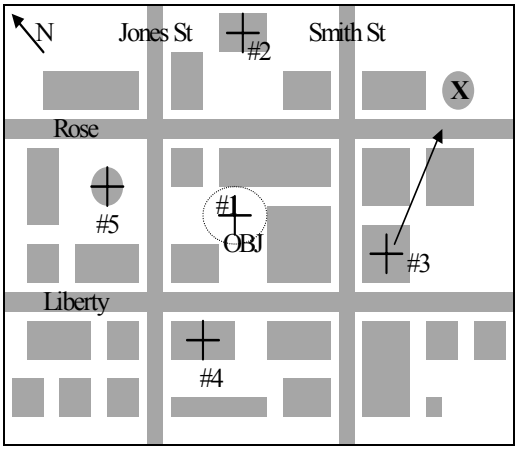
Figure B-4. Bull's-eye/Checkpoint targeting.

"Checkpoint, Charlie. 105 degrees magnetic, 250 meters, ZPU on the roof."



"Echo-2, main entry on Elm."

Figure B-5. Objective area reference grid.



"TRP #3, 087 degrees magnetic, 325 meters, the water tower."

Figure B-6. TRP.

(2) ***Additional Cues.*** Physical terrain features and visual markings provide additional guidance for identification purposes.

(a) *Roof Characteristics*. Flat roofs, pitched roofs, domed roofs, and roofs with towers or air conditioning units on top will aid in visual and thermal acquisition. Additional structural features revealed in imagery will aid in confirmation. This method of terrain association will prove invaluable for visual engagement or reconnaissance since structures are often too close for reliance on mere grid coordinates.

(b) *Visual Markings*. The visual signaling or marking of positions allows more ease in determining the location of friendly forces. During building clearing operations, the progress of friendly units (both horizontally and vertically) may be marked with spray paint or bed sheets hung out of windows. The simplest methods are often the best. Traditional signaling devices, such as flares, strobes, and signaling mirrors, may be effective as well. Target marking or an orientation on enemy positions may also be accomplished using signaling procedures. The use of GLINT tape, combat ID panels, and infrared beacons assist in the ID of friendly ground forces on urban terrain. Standardized usage of ground lighting, thermal contrast, and interposition of structures influence the effectiveness of these devices.

(c) *Shadows.* During both high and low ambient light conditions, expect to see significant urban shadowing from buildings when cultural lights are present. Shadows will hide personnel and or vehicular targets like the shadows that hide small hills against the background of larger mountains. Shadows will hide non-thermally significant targets, but thermal targets should still be seen. A combination of sensors will need to be used to acquire and identify the target; therefore, a sensor hand-off plan must be thoroughly briefed.

(d) *Global Positioning System.* The use of aircraft with integrated GPS will reduce the amount of time spent finding the target area. If ground forces can provide accurate coordinates, inputting a target grid into the GPS or INS will provide fire control cues (range, heading, time) to the target that will aid in quicker target acquisition and help distinguish friendly forces from enemy forces.

e. **Attack Helicopter Engagement.** Attack helicopters will conduct a variety of TTPs to engage targets in the urban area. Techniques range from support by fire and or attack by fire at maximum standoff ranges to running and or diving fire and close combat attack at minimum engagement ranges. Coordination is imperative to ensure positive ID of the target as well as friendly locations.

(1) Urban terrain introduces a unique challenge to aircrews and ground personnel alike with the notion of the urban canyon. Simply stated, an urban canyon exists when a target or target set is shielded by vertical structures. Unlike most natural terrain, the vertical characteristics of urban terrain can greatly affect delivery options. Urban terrain typically creates corridors of visibility running between structures. Street level targets are only visible along the street axis or from high angles. The interposition of structures around a target interrupts LOS from many directions. The presence of buildings and other structures in urban terrain creates corridors of visibility along streets, rivers, and railways. LOS must be maintained for enough time to acquire the target, achieve a weapons delivery solution, and fly to those parameters. This timeline is reduced during the employment of the AH-64D. A precise navigation system enables the aircraft to slave its sensors and weapons to a stored target, thereby significantly reducing target acquisition times. In some cases, the AH-64D may employ the gun or folding-fin aerial rockets (FFARs) in an "indirect" mode and never have to expose the aircraft to the target area. (Ground forces should make every attempt to pass along accurate 8-digit grid coordinates as the AH-64D can easily and accurately engage targets using this method.)

(2) Visibility limitations on marking devices in the urban environment are geometric in nature. The use of any pointer or laser requires LOS. In addition, the aircraft must have LOS with the target to see the mark. Urban terrain severely limits LOS opportunities. Due to the close proximity of structures to one another, there may be very narrow fields of view and limited axes of approach. The high number of reflective surfaces in an urban setting presents an additional challenge. Laser energy can be reflected and present multiple false returns. For these reasons, fire support can be expected to be more time consuming and much more dependent on good communications.

(3) Combinations of marking devices and clear talk-on procedures will be essential to safe and effective fire support. Ground forces should consider using buddy lasing or remote lasing tactics for laser guided munitions when urban effects preclude the attacking aircraft from maintaining LOS with the target until ordnance impact. However, if designating with a ground-based laser along a narrow street bounded by tall buildings,

LOS geometry may allow the weapon to receive reflected laser energy. Aircrews must also consider the potential miss distances for "precision" munitions when their guidance source is interrupted or removed.

(4) Armed helicopters can carry a mix of weapons. Commanders must choose the weapons to use on a specific mission based on their effects on the target, employment techniques, and the target's proximity to ground forces. Planners must consider proportionality, collateral damage, and non-combatant casualties. Planners and aircrew must consider the following when choosing weapons:

- Hard, smooth, flat surfaces with 90 degree angles are characteristic of man-made targets. Due to aviation delivery parameters, munitions will normally strike a target at an angle less than 90 degrees. This may reduce the effect of munitions and increase the chance of ricochets. The tendency of rounds to strike glancing blows against hard surfaces means that up to 25 percent of impact-fuzed rounds may not detonate when fired onto areas of rubble.
- Identification and engagement times are short.
- Depression and elevation limits create dead space. Target engagement from oblique angles, both horizontal and vertical, must be considered.
- Smoke, dust, and shadows mask targets. Additionally, rubble and man-made structures can mask fires. Targets, even those at close range, tend to be indistinct.
- Urban fighting often involves units attacking on converging routes. The risks from friendly fires, ricochets, and fratricide must be considered during the planning of operations.
- The effect of the weapon and the position of friendly and or enemy personnel with relation to structures must be considered. Choose weapons for employment based on their effects against the building material composition rather than against enemy personnel.
- Munitions can produce secondary effects, such as fires.